

What is claimed is:

- 1 1. A method for fabricating simultaneously a phase separated organic film with
2 alignment, comprising:
3 preparing a mixture of liquid crystal, prepolymer and a polarization-sensitive
4 material;
5 disposing said mixture on a substrate;
6 applying a polarized light from a light source; and
7 inducing phase separation of said mixture simultaneously during said applying
8 step, thereby forming a separate layer of homogeneously aligned liquid crystal
9 material adjacent a separate and distinct layer of polymer and said polarization-
10 sensitive material on said substrate, wherein alignment of the phase separated liquid
11 crystal layer is induced by the alignment of the polymer and polarization-sensitive
12 material layer.

- 1 2. The method according to claim 1, further comprising:
2 disposing a second substrate over said layers.

- 1 3. The method according to claim 1, wherein said applying step causes at least a major
2 portion of said polarization-sensitive material to mix with said prepolymer, said
3 polarization-sensitive material imparting alignment properties to said liquid crystal
4 material.

- 1 4. The method according to claim 1, further comprising:
2 interposing a polarizer between said light source and said substrate to impart a
3 desired orientational alignment to said liquid crystal material.

- 1 5. The method according to claim 4, further comprising:
2 positioning an ultraviolet light source near said substrate opposite the side with
3 said disposed mixture.

- 1 6. The method according to claim 4, further comprising:
2 positioning a visible light source near said substrate opposite the side with said
3 disposed mixture.

- 1 7. The method according to claim 2, further comprising:
2 preparing an initial mixture of an initial prepolymer and an initial polarization-
3 sensitive material; and
4 coating said initial mixture on said second substrate prior to said mixture
5 disposing step.

- 1 8. The method according to claim 7, wherein said initial polarization-sensitive material
2 is sensitive to a different wavelength of light than said polarization-sensitive material.

- 1 9. The method according to claim 8, further comprising:
2 applying an initial polarized light to said initial mixture prior to said mixture
3 disposing step to impart an alignment orientation thereto.

- 1 10. The method according to claim 8, further comprising:
2 applying an initial polarized light to said initial mixture after said mixture
3 disposing step to impart an alignment orientation thereto.

- 1 11. The method according to claim 10, further comprising:
2 positioning a mask and a polarizer between said light source and said substrate
3 prior to said applying step so as to form said layer of liquid crystal with
4 microstructures, wherein all of said microstructures are adjacent to said second
5 substrate.

- 1 12. The method according to claim 11, further comprising:
2 positioning another mask between said light source and said substrate after said
3 initial applying step.

- 1 13. The method according to claim 7, wherein said initial polarization-sensitive material
2 and said polarization material are activated by either ultraviolet or visible light.

- 1 14. The method according to claim 1, wherein said prepolymer is a thermally activated
2 prepolymer; and wherein said step of inducing phase separation includes thermally
3 activating said mixture to induce phase separation.
- 1 15. The method according to claim 14, wherein said polarized light is either visible or
2 ultraviolet.
- 1 16. The method according to claim 7, further comprising:
2 preparing said initial mixture with epoxy and resin; and
3 permitting phase separation of said initial mixture to induce phase separation
4 of said initial mixture and impart an alignment orientation to said liquid crystal.
- 1 17. The method according to claim 16, wherein said polarized light is either visible or
2 ultraviolet.
- 1 18. The method according to claim 2, further comprising:
2 positioning a mask and a polarizer between said light source and said substrate
3 prior to said applying step so as to form said layer of liquid crystal with
4 microstructures, wherein all of said microstructures are adjacent to said second
5 substrate.
- 1 19. A method for fabricating a liquid crystal device with alignment properties comprising:
2 providing a substrate;
3 providing a first mixture comprising at least a first polarization-sensitive agent,
4 and a prepolymer;
5 providing a second mixture comprising at least a second polarization-sensitive
6 agent and a prepolymer;
7 mixing into either said first or second mixture a liquid crystal;
8 disposing said first mixture on to said substrate;
9 disposing said second mixture over said first mixture;
10 initiating a first phase separation process to said first mixture from the group
11 consisting of at least visible light polarization, ultraviolet light polarization, thermal
12 induction, chemical induction, and solvent induction;

13 initiating a second phase separation process to said second mixture from the
14 group consisting of at least visible light polarization, ultraviolet light polarization,
15 thermal induction, chemical induction, and solvent induction; and
16 said processes imparting orientational alignments to said liquid crystal.

1 20. The method according to claim 19, wherein one of said initiating steps includes at
2 least simultaneous application of one of said polarization processes and one of said
3 induction processes so as to phase separate said liquid crystal from said prepolymer.

1 21. The method according to claim 19, further comprising:
2 securing a second substrate to said first substrate with said first and second
3 mixtures therebetween.

1 22. The method according to claim 19, wherein said polarization processes comprise:
2 positioning a light source near said substrate; and
3 positioning a polarizer between said substrate and said light source.

1 23. The method according to claim 19, further comprising:
2 re-positioning said polarizer after said first initiating step, wherein said
3 polarization-sensitive agents impart different orientational alignments at their
4 respective interfaces with said liquid crystal.

1 24. The method according to claim 19, wherein said first or second phase separation
2 process separates said prepolymer and said polarization-sensitive agent from said
3 liquid crystal.

1 25. A cell having alignment properties, comprising:
2 at least one substrate; and
3 a mixture disposed on said substrate, said mixture comprising at least a liquid
4 crystal material, a prepolymer material and a polarization-sensitive material, wherein
5 said mixture is capable of separation into a microstructure of liquid crystal material
6 adjacent polymer and polarization-sensitive material upon polymerization of the
7 prepolymer and simultaneous exposure to polarized light, wherein said liquid crystal

8 material is distributed non-randomly relative to said polymer and polarization
9 sensitive material, and wherein said polymer and polarization-sensitive material
10 layer is capable of imparting alignment properties to said liquid crystal material.

1 26. The cell according to claim 25, further comprising:
2 a second mixture disposed on said substrate prior to said first mixture,
3 said second mixture comprising at least a second polarization-sensitive material
4 and

4 wherein application of polarized light causes photo-alignment of said second mixture
5 that imparts alignment properties to said liquid crystal material.

1 27. The cell according to claim 26, wherein distinct and separate interfaces are formed
2 between said liquid crystal material and said microstructure of polymer and said
3 polarization-sensitive material, and between said liquid crystal material and said
4 second polarization-sensitive material.

1 28. The cell according to claim 27, wherein said interfaces align said liquid crystal
2 material in different orientations.

1 29. The cell according to claim 28, wherein said liquid crystal material is formed into
2 microstructures.